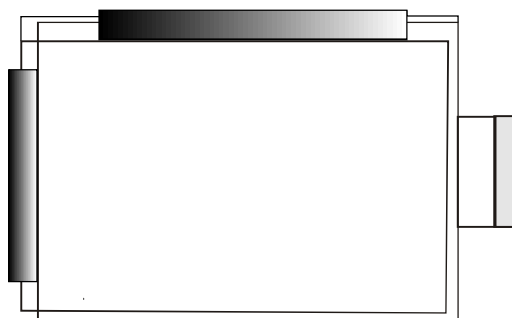




## PRODUCT SPECIFICATION

# HDM240GS16-2

240x160 GRAPHICS  
LCD DISPLAY MODULE



|                                                          |             |              |              |                |
|----------------------------------------------------------|-------------|--------------|--------------|----------------|
| HANTRONIX, INC.<br>10080 BUBB RD.<br>CUPERTINO, CA 95014 | Q.A.:<br>JK | REV.:<br>1.0 | HDM240GS16-2 | SHEET 1 OF 17  |
|                                                          |             |              |              | DATE: 11/29/01 |

# 1. MECHANICAL DATA

|                       |                                                                                       |         |      |                       |
|-----------------------|---------------------------------------------------------------------------------------|---------|------|-----------------------|
| (1) Product No.       | <b>HDM240GS16-2</b>                                                                   |         |      |                       |
| (2) Module Size       | 101                                                                                   | (W)mm X | 67.0 | (H)mm X MAX 5.3 (D)mm |
| (3) Dot Size          | 0.31                                                                                  | (W)mm X | 0.31 | (H)mm                 |
| (4) Dot Pitch         | 0.32                                                                                  | (W)mm X | 0.32 | (H)mm                 |
| (5) Number of Dots    | 240                                                                                   | (W) X   | 160  | (H) Dots              |
| (6) Duty              | 1/160                                                                                 |         |      |                       |
| (7) LCD Display Mode  | FSTN: Black and White(Normally White/Positive Image)<br>Rear Polarizer: Transflective |         |      |                       |
| (8) Viewing Direction | 6 O'clock                                                                             |         |      |                       |
| (9) Backlight         | EL                                                                                    |         |      |                       |
| (10) Weight           | 30 g                                                                                  |         |      |                       |
| (11) Controller       | Excluded                                                                              |         |      |                       |
| (12) DC/DC Converter  | Excluded                                                                              |         |      |                       |

|                                                                 |             |              |                     |                   |
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## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

VSS=0 V Standard

| ITEM                   | SYMBOL  | MIN  | MAX | UNIT | COMMENT |
|------------------------|---------|------|-----|------|---------|
| Power Supply for Logic | VDD-VSS | -0.3 | 6.5 | V    |         |
| Input Voltage          | VEE-VSS | 0    | 27  | V    |         |
| Static Electricity     | -       | -    | -   | -    | Note 1  |

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM                            | OPERATING |      | STORAGE                 |      |
|---------------------------------|-----------|------|-------------------------|------|
|                                 | MIN.      | MAX. | MIN.                    | MAX. |
| Ambient Temperature             | -20       | 70   | -30                     | 80   |
| Humidity (Without Condensation) | Note 2,4  |      | Note 3,4                |      |
| Vibration(Note 5)               | -         |      | 49m/s <sup>2</sup> (5G) |      |

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≤ 70°C : 75%RH max

Ta > 70°C : Absolute humidity must be lower  
than the humidity of 85%RH at 50°C

Note 3 Ta at -30°C will be < 48 hrs, at 80°C will be < 120 hrs

Note 4 Background color will change slightly depending on ambient temperature.  
That phenomenon is reversible.

Note 5

|                     |                             |
|---------------------|-----------------------------|
| Frequency (HZ)      | 10~55~10/1 min              |
| Vibration Width     | 1.5 m/m                     |
| Vibration Direction | X/Y/Z                       |
| Vibration Time      | 15 min/cycle X 3 directions |

|                                                                 |             |              |                     |                |
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### 3. ELECTRICAL CHARACTERISTICS

( VDD= 3.3V ± 10% )

| ITEM                                                  | SYMBOL           | CONDITION                                         | MIN.   | TYP. | MAX.   | UNIT |
|-------------------------------------------------------|------------------|---------------------------------------------------|--------|------|--------|------|
| Input Voltage                                         | VIH              | H level                                           | 0.8VDD | —    | VDD    | V    |
|                                                       | VIO              | L level                                           | 0      | —    | 0.2VDD | V    |
| Recommended<br>LC Driving Voltage<br>(Wide TEMP. LCM) | VEE-VSS<br>(Vop) | 1/160<br>Duty<br>1/13<br>Bias                     | -20°C  | 21.4 | 21.7   | 22.0 |
|                                                       |                  |                                                   | 0°C    | 20.0 | 20.3   | 20.6 |
|                                                       |                  |                                                   | 25°C   | 18.9 | 19.2   | 19.5 |
|                                                       |                  |                                                   | 50°C   | 17.4 | 17.7   | 18.0 |
|                                                       |                  |                                                   | 70°C   | 16.3 | 16.6   | 16.9 |
| Power Supply Current                                  | IDD              | VDD= 3.3V<br>VSS= 0V<br>VEE-VSS=19.2V<br>FLM=70Hz | —      | 0.09 | 0.5    | mA   |
|                                                       | IEE              |                                                   | —      | 1.8  | 3      |      |

|     |                      |    |                              |                                                                                                                  |   |     |   |                   |
|-----|----------------------|----|------------------------------|------------------------------------------------------------------------------------------------------------------|---|-----|---|-------------------|
| LCM | Surface<br>Luminance | EL | AC : 65V,250HZ<br>Is : 2.2mA | PATTERN<br>(Dots ALL Off)<br> | — | 0.5 | — | cd/m <sup>2</sup> |
|     |                      |    |                              | PATTERN<br>(Dots ALL On)<br>  | — | 2   | — | cd/m <sup>2</sup> |

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## 4.OPTICAL CHARACTERISTICS

AT Vop

| ITEM<br>MODE |   | Cr(Contrast Ratio) |      |      |      |      |      |      |      |      |      | $\theta$ (Viewing Angle) |       | $\phi$ (Viewing Angle) |       |
|--------------|---|--------------------|------|------|------|------|------|------|------|------|------|--------------------------|-------|------------------------|-------|
|              |   | -20°C              |      | 0°C  |      | 25°C |      | 50°C |      | 70°C |      | 25°C                     |       | 25°C                   |       |
|              |   | MIN.               | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN.                     | TYP.  | MIN.                   | TYP.  |
| Z            | V | —                  | 6.5  | —    | 8.5  | —    | 8.5  | —    | 6.0  | —    | 3.5  | —                        | 33-34 | —                      | 36-40 |
| NOTE         |   | NOTE6              |      |      |      |      |      |      |      |      |      | NOTE5                    |       |                        |       |

NOTE : Z:OTHER

V:OTHER, 6 O'CLOCK

AT  $\phi=0^\circ$   $\theta=0^\circ$

| ITEM                 | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE   |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr     | -20°C     | —    | 2400 | —    | ms   | NOTE 2 |
|                      |        | 0°C       | —    | 550  | —    |      |        |
|                      |        | 25°C      | —    | 200  | —    |      |        |
|                      |        | 50°C      | —    | 100  | —    |      |        |
|                      |        | 70°C      | —    | 70   | —    |      |        |
| Response Time (fall) | Tf     | -20°C     | —    | 1200 | —    | ms   | NOTE 2 |
|                      |        | 0°C       | —    | 250  | —    |      |        |
|                      |        | 25°C      | —    | 80   | —    |      |        |
|                      |        | 50°C      | —    | 60   | —    |      |        |
|                      |        | 70°C      | —    | 50   | —    |      |        |

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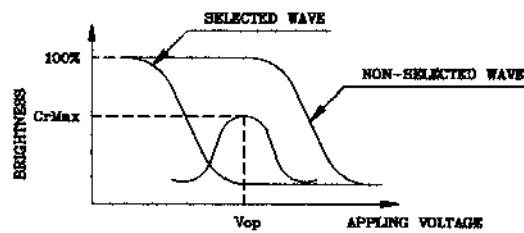
SHEET 5 OF 17

DATE:

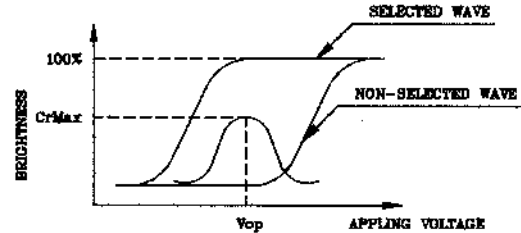
11/29/01

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

\*Conditions

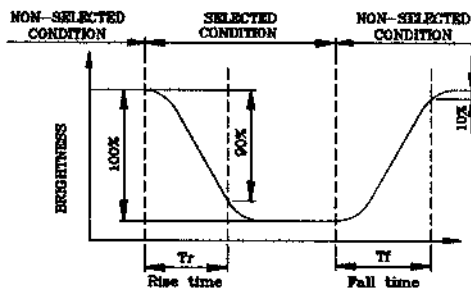
Viewing Angle : 0

Frame Frequency : 70Hz

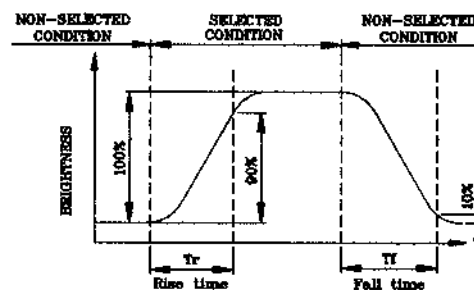
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

\*Conditions

Operating Voltage : Vop

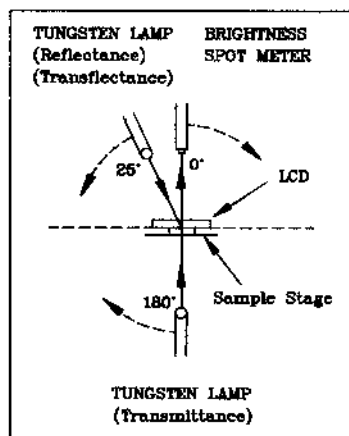
Viewing Angle (θ,φ) : (0,0)

Frame Frequency : 70Hz

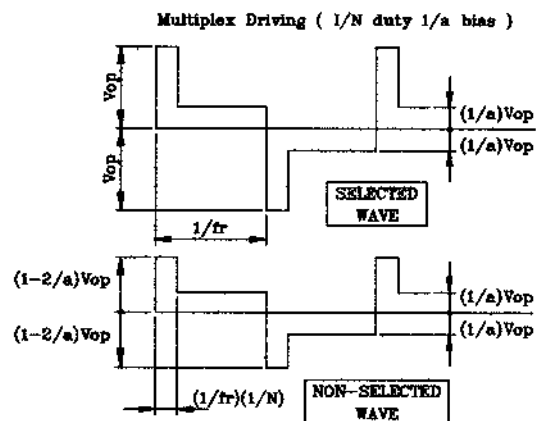
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

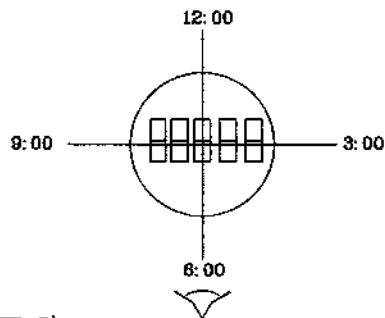


CONST.  
TEMP.  
CHAMBER



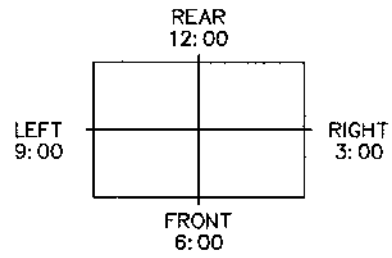
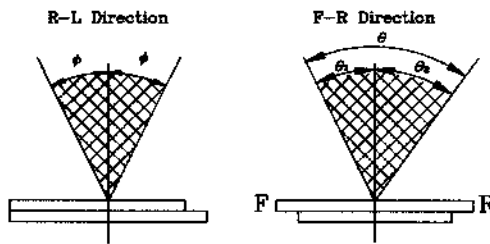
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product  
The Viewing Direction Is 6 O'clock  
So  $\theta_1 > \theta_2$

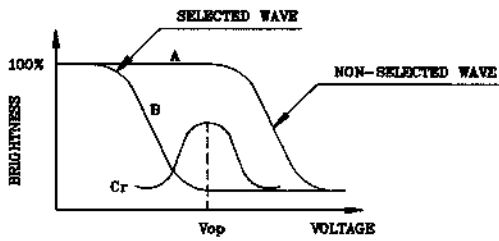
$$\theta = \theta_1 + \theta_2$$

\*Conditions

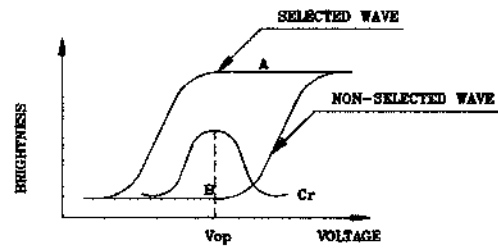
Operating Voltage : Vop  
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

\*Conditions

Viewing Angle : 0  
Frame Frequency : 70Hz  
Applying Waveform : 1/N duty 1/a bias

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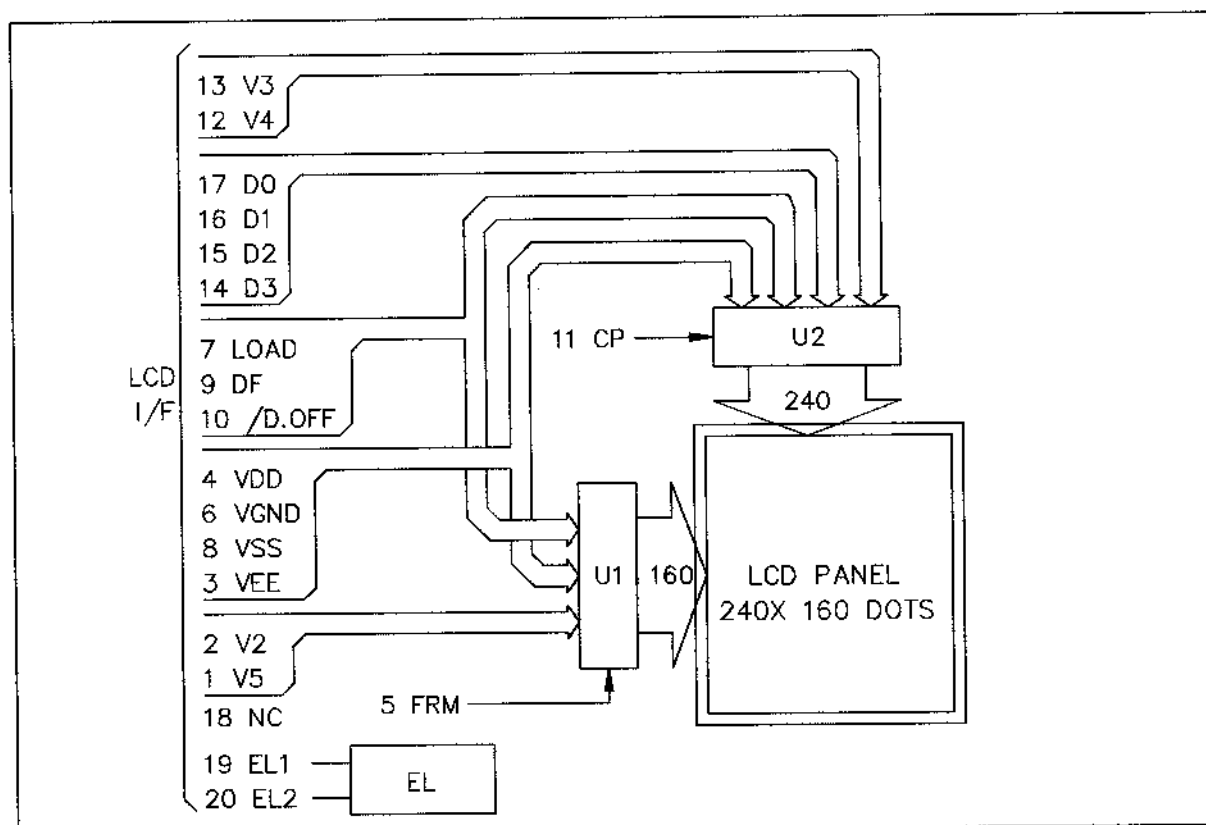
REV.:  
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## 5. BLOCK DIAGRAM



Note1 :

- 1) Controller and bias voltage supply circuit are not included.
- 2) VEE, VGND, V2, V3, V4 and V5 are power supply voltage for LCD.  
( $VEE > V2 > V3 > V4 > V5 > VGND$ )
- 3) The bias is  $1/13$ ,  $VOP = VEE - VSS = 19.2 \text{ V}$ .

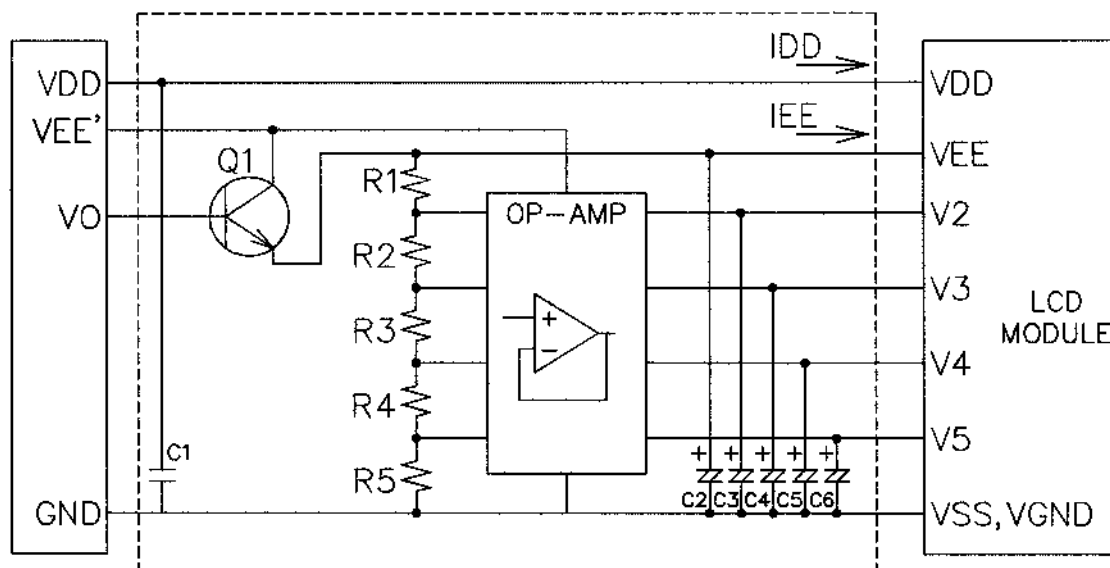
|                                                                 |             |              |                     |                   |
|-----------------------------------------------------------------|-------------|--------------|---------------------|-------------------|
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## 6.INTERNAL PIN CONNECTION

| Pin No. | Symbol | Function                                                                    |
|---------|--------|-----------------------------------------------------------------------------|
| 1       | V5     | Bias voltage for non-select (Common driver)                                 |
| 2       | V2     | Bias voltage for non-select (Common driver)                                 |
| 3       | VEE    | Power supply for LCD (+V)                                                   |
| 4       | VDD    | Power supply for logic (+3.3V)                                              |
| 5       | FRM    | Frame start signal (Data signal of the shift register of the common driver) |
| 6       | VGND   | GND,Power supply for LCD                                                    |
| 7       | LOAD   | 1)Latch pulse of display data<br>2)Shift clock for common driver            |
| 8       | VSS    | GND                                                                         |
| 9       | DF     | Switch signal to convert LCD drive waveform into AC                         |
| 10      | /D.OFF | H : Display ON, L : Display OFF                                             |
| 11      | CP     | Clock pulse for segment shift register                                      |
| 12      | V4     | Bias voltage for non-select (Segment driver)                                |
| 13      | V3     | Bias voltage for non-select (Segment driver)                                |
| 14      | D3     | Input data signal                                                           |
| 15      | D2     | Input data signal                                                           |
| 16      | D1     | Input data signal                                                           |
| 17      | D0     | Input data signal                                                           |
| 18      | N.C.   | No connectoin                                                               |
| 19      | EL1    | Power supply for EL backlight                                               |
| 20      | EL2    | Power supply for EL backlight                                               |

## 7. POWER SUPPLY



Q1 : 2SC1815

OP-AMP : LP324

$R1=R2=R4=R5=10K\Omega$ ,  $R3=9R1=91K\Omega$  (1/13 Bias)

$C1=0.1\mu F$ ,  $C2\sim C6=3.3\mu F$

Note 1 : These are general values.

In case to decrease LCD driving voltage with minimizing bias value, set these values with check display to avoid display's deterioration (response etc).

|                                                                 |             |              |                     |                   |
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# 8.TIMING CHARACTERISTICS

## 8-1 INTERFACE TIMING

Ⓢ VDD=3.3V±10%, Ta= 0~50 ℃

| Item                   | Symbol    | Test condition | Min. | Typ. | Max. | Unit |
|------------------------|-----------|----------------|------|------|------|------|
| CP Cycle Time          | tC        | Fig.a          | 82   | —    | —    | ns   |
| CP Pulse Width         | tSWH,tSWL | Fig.a          | 28   | —    | —    | ns   |
| CP Rise/Fall Time      | tCR,tCF   | Fig.a          | —    | —    | 50   | ns   |
| Data Set Up Time       | tDSU      | Fig.a , Fig.b  | 20   | —    | —    | ns   |
| Data Hold Time         | tDHD      | Fig.a , Fig.b  | 23   | —    | —    | ns   |
| LOAD Cycle Time        | tL        | Fig.b          | 250  | —    | —    | ns   |
| LOAD "H" Pulse Width   | tLWH      | Fig.a , Fig.b  | 30   | —    | —    | ns   |
| LOAD Rise/Fall Time    | tLR,tLF   | Fig.b          | —    | —    | 50   | ns   |
| CP To LOAD Delay Time  | tCL       | Fig.a          | 30   | —    | —    | ns   |
| LOAD To CP Delay Time  | tLC       | Fig.a          | 65   | —    | —    | ns   |
| FRM TO LOAD SETUP TIME | tFLS      | Fig.b          | 30   | —    | —    | ns   |
| FRM TO LOAD HOLD TIME  | tFLH      | Fig.b          | 50   | —    | —    | ns   |

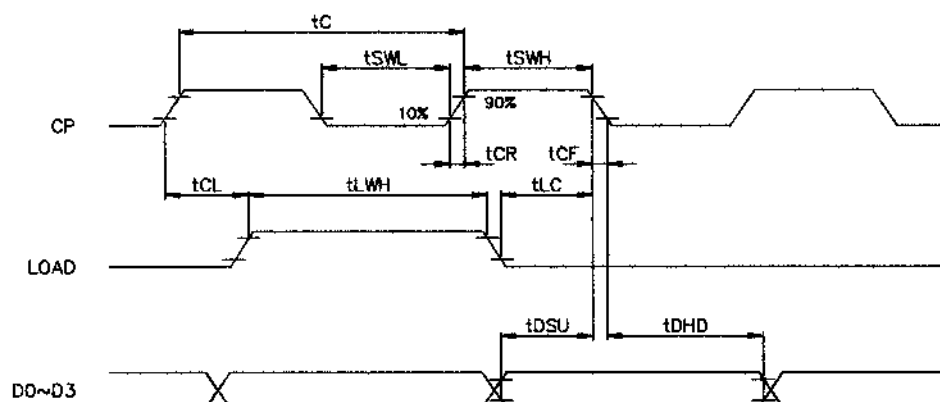


Fig . a Interface timing (SEGMENT)

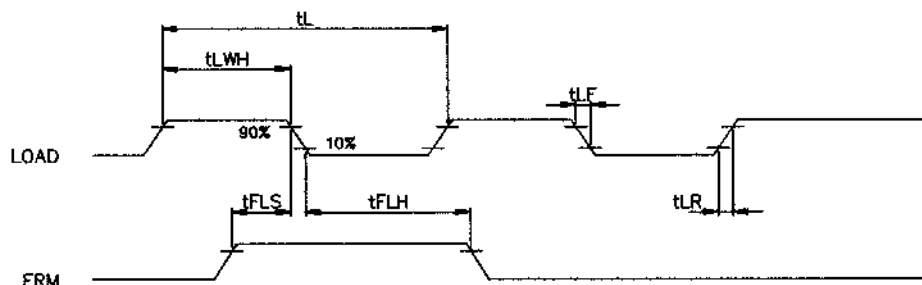


Fig . b Interface timing (COMMON)

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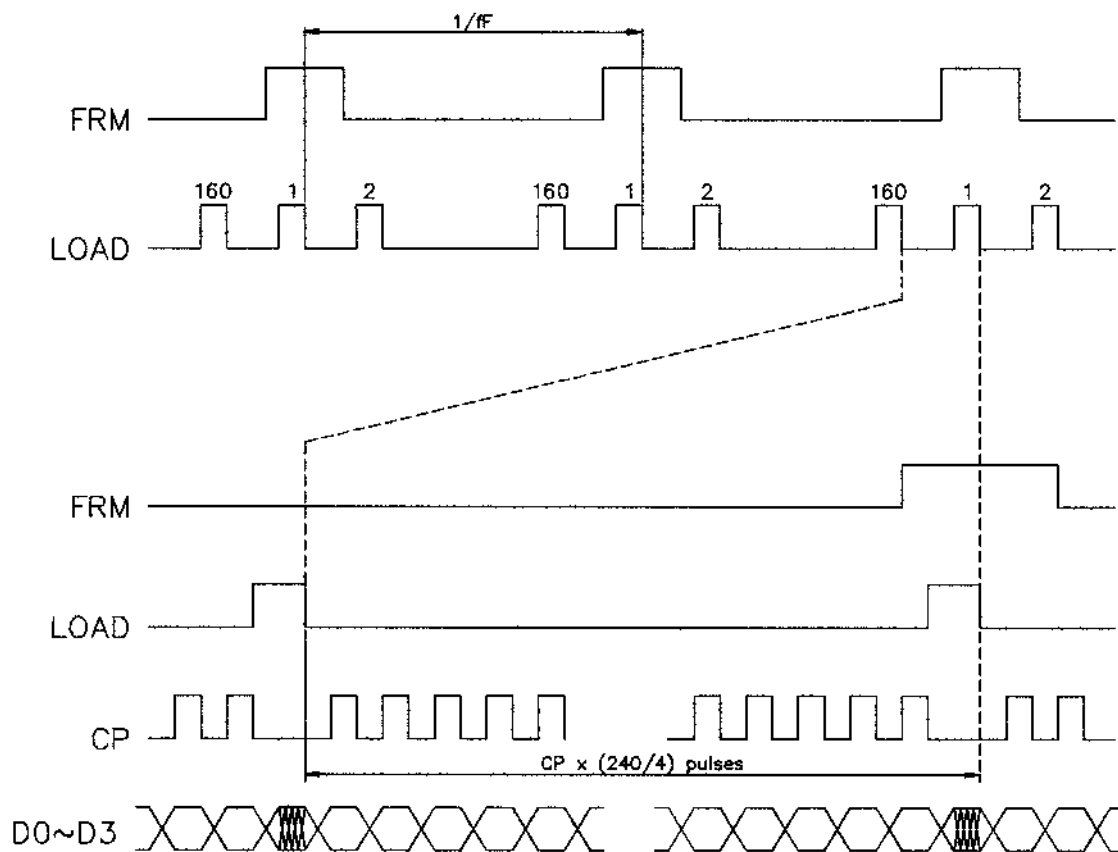
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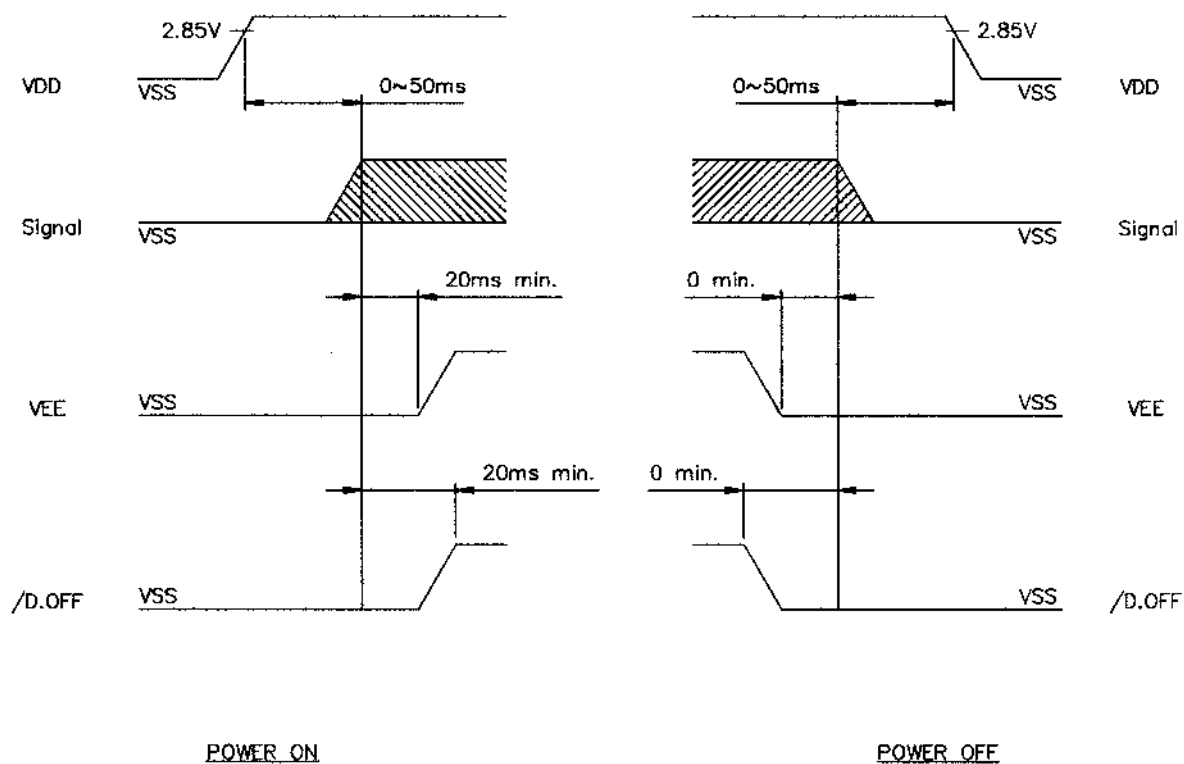
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## 8-2 TIMING CHART OF INPUT SIGNAL



## 8-3 POWER ON/OFF TIMING

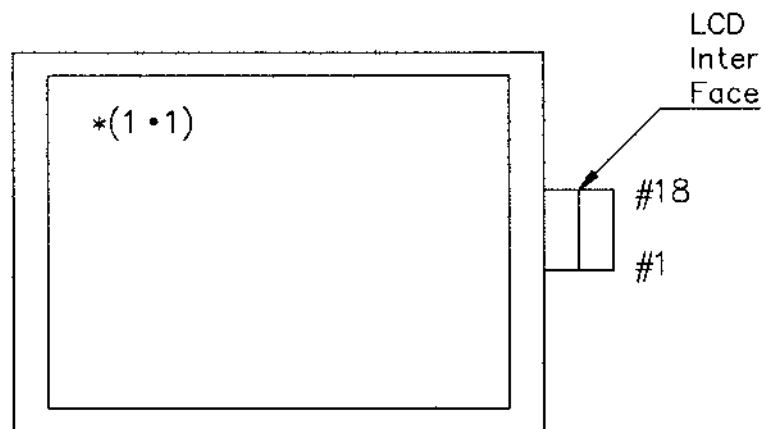


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

|                                                                 |             |              |                     |                   |
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## 8-4 DISPLAY PATTERN

|                                                                                                                                                                                             | Column1 | Column2 | Column3 | Column4 | Column240 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|-----------|
| Row 1                                                                                                                                                                                       | 1 • 1   | 1 • 2   | 1 • 3   | 1 • 4   | 1 • 240   |
| Row 2                                                                                                                                                                                       | 2 • 1   | 2 • 2   | 2 • 3   |         |           |
| Row 3                                                                                                                                                                                       | 3 • 1   | 3 • 3   |         |         |           |
| <p>D0: (1 • 4) \ (1 • 8) ..... (160 • 240)</p> <p>D1: (1 • 3) \ (1 • 7) ..... (160 • 239)</p> <p>D2: (1 • 2) \ (1 • 6) ..... (160 • 238)</p> <p>D3: (1 • 1) \ (1 • 5) ..... (160 • 237)</p> |         |         |         |         |           |
| Row 160                                                                                                                                                                                     | 160 • 1 |         |         |         | 160 • 240 |



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## 9. RELIABILITY TEST

| NO | ITEM                                  | CONDITION                                                           |       |  | STANDARD                     | NOTE        |
|----|---------------------------------------|---------------------------------------------------------------------|-------|--|------------------------------|-------------|
| 1  | HIGH TEMP.<br>STORAGE                 | 70°C                                                                | 120HR |  | Appearance<br>without defect |             |
| 2  | LOW TEMP.<br>STORAGE                  | -20°C                                                               | 120HR |  | Appearance<br>without defect |             |
| 3  | HIGH TEMP. &<br>HIGH HUMI.<br>STORAGE | 40°C<br>90%RH                                                       | 120HR |  | Appearance<br>without defect |             |
| 4  | THERMAL<br>SHOCK                      | -20°C, 30min → 25°C, 5min<br>→ 60°C, 30min → 25°C, 5min<br>(1cycle) |       |  | Appearance<br>without defect | 5<br>cycles |

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NOTICE:

- SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE

- 1.Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

- TERMS OF WARRANT

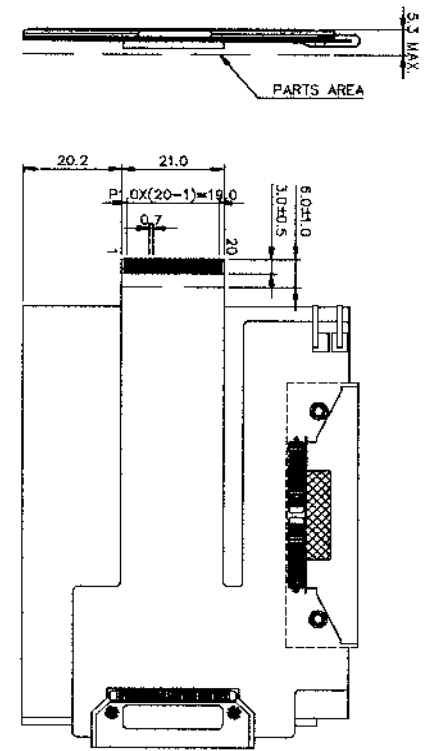
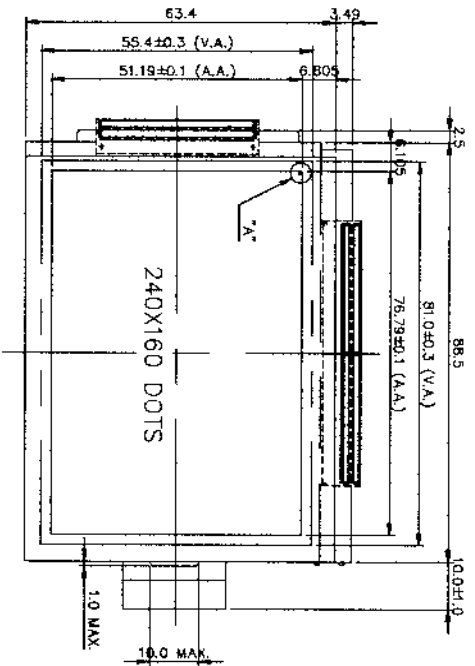
- 1.Acceptance inspection period  
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period  
The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT

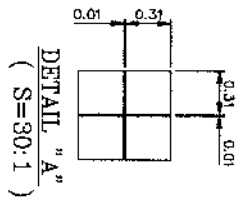
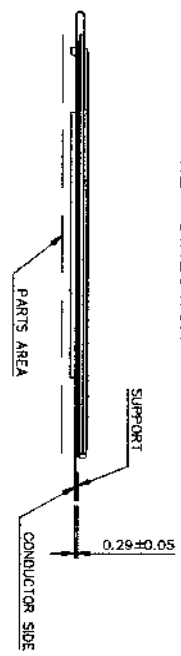
- EL : 2000hrs for AC 100Vrms, 400Hz, 20°C, 60%RH  
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

|                                                          |                 |                  |              |                |
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VIEW DIRECTION  
→



| PIN NO | SYMBOL | FUNCTION                                                                    | PIN NO | SYMBOL | FUNCTION                                     |
|--------|--------|-----------------------------------------------------------------------------|--------|--------|----------------------------------------------|
| 1      | V5     | Bias voltage for non-select (Common driver)                                 | 10     | /D OFF | H: Display ON, L: Display OFF                |
| 2      | V2     | Bias voltage for non-select (Common driver)                                 | 11     | CP     | Clock pulse for segment shift register       |
| 3      | VEE    | Power supply for LCD (+V)                                                   | 12     | V4     | Bias voltage for non-select (Segment driver) |
| 4      | VDD    | Power supply for logic (+3.3V)                                              | 13     | V3     | Bias voltage for non-select (Segment driver) |
| 5      | FRM    | Frame start signal (Data signal of the shift register of the common driver) | 14     | D3     | Input data signal                            |
| 6      | VGND   | GND, Power supply for LCD                                                   | 15     | D2     | Input data signal                            |
| 7      | LOAD   | 1) Latch pulse of display data<br>2) Shift clock for common driver          | 16     | D1     | Input data signal                            |
| 8      | VSS    | GND                                                                         | 17     | DO     | Input data signal                            |
| 9      | DF     | Shift signal to convert LCD drive waveform into AC                          | 18     | NC     | No connection                                |
|        |        |                                                                             | 19     | EL 1   | Power supply for EL backlight                |
|        |        |                                                                             | 20     | EL 2   | Power supply for EL backlight                |

- NOTES:
- 1.RESOLUTION: 240X160 DOTS
  - 2.BACKLIGHT: EL (WHITE)
  - 3.GLASS THICKNESS: MAX. 2.0mm
  - 4.PCB THICKNESS: 1.0±0.2mm
  - 5.COMMON DRIVER: LH156018 (TAB)
  - 6.SEGMENT DRIVER: LH1564F4 (TAB)
  - 7.POLARIZER TYPE: 3M

| GENERAL TOLERANCE LIST |            |
|------------------------|------------|
| DIMENSION              | TOLERANCE  |
| L ≤ 6                  | ±0.25 (mm) |
| 6 < L ≤ 18             | ±0.3 (mm)  |
| 18 < L ≤ 50            | ±0.4 (mm)  |
| 50 < L ≤ 125           | ±0.5 (mm)  |
| 125 < L                | ±0.6 (mm)  |
| ANGLE                  | ±1° (DEG)  |